DEPARTMENT OF COMMERCE
BUREAU OF FISHERIES
HENRY O'MALLEY, Commissioner

THE ICHTHYOPHTHIRIUS DISEASE OF FISHES, AND METHODS OF CONTROL

By HERBERT F. PRYTHERCH
Scientific Assistant, U. S. Bureau of Fisheries

APPENDIX IX TO THE REPORT OF THE U. S. COMMISSIONER OF FISHERIES FOR 1923

Bureau of Fisheries Document No. 959

PRICE, 5 CENTS
Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

Digitized by the Internet Archive
in 2025

https://archive.org/details/report-of-the-united-states-commissioner-of-fisheries_1923_appendix-9

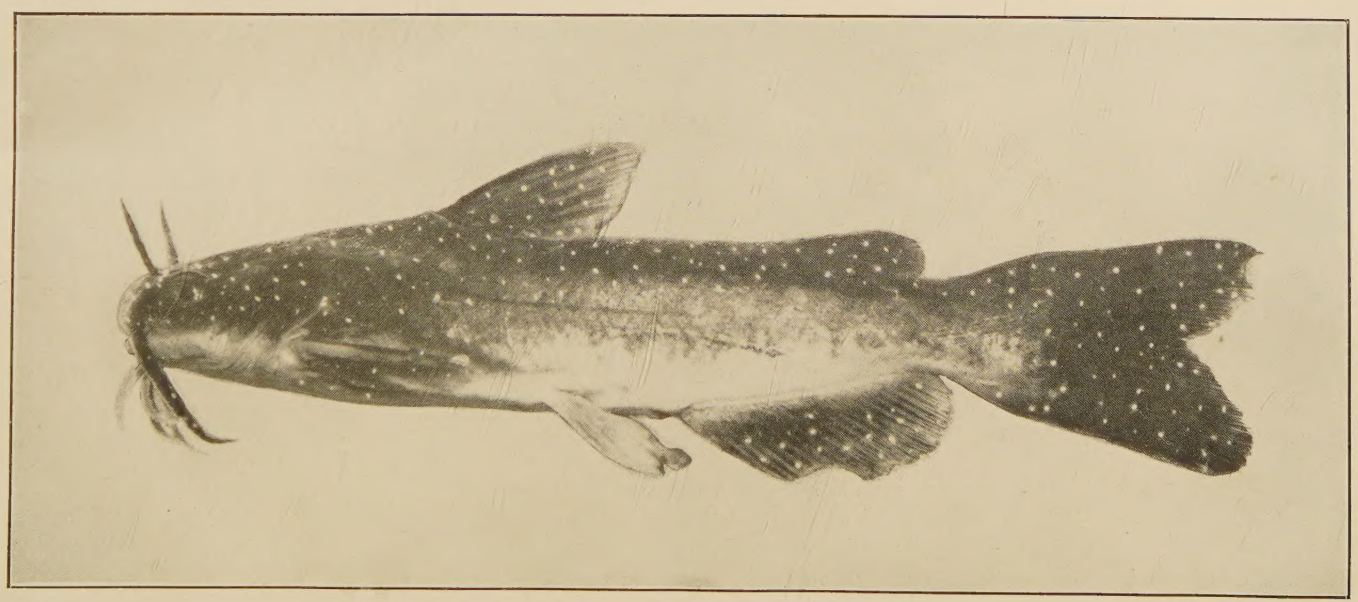

FIG. 1.—Catfish infected with the parasite *Ichthyophthcrius multifiliis*

THE ICHTHYOPHTHIRIUS DISEASE OF FISHES AND METHODS OF CONTROL.[1]

By HERBERT F. PRYTHERCH, *Scientific Assistant, U. S. Bureau of Fisheries.*[2]

CONTENTS.

	Page.
Introduction	1
Occurrence of the disease	1
Symptoms of the disease	2
Description of the parasite	2
Life history of the parasite	2
Treatment and control of the disease	4
Economic importance	6

INTRODUCTION.

The unusual occurrence of the parasitic ciliate, *Ichthyophthirius multifiliis* (Fouquet), on fish in the Washington aquarium during the cold winter months led to a series of experiments to determine more efficient methods of combating the disease. Catfish, bass, bream, and sunfish that were brought in from Maryland waters and the Potomac River in the late fall were found, after a week's confinement in the aquaria, to be heavily infected with the parasite. The steadily lowering temperature did not halt the disease, but only served to render its treatment more difficult.

OCCURRENCE OF THE DISEASE.

The parasitic protozoan Ichthyophythirius is found on fish in their natural environment as well as on fish in aquaria and artificial ponds. In nature fish seldom are killed by the disease, as the possibility of heavy infection by the young parasites is greatly reduced by the large expanse of water and the movements of the fish.

Serious epidemics have occurred from time to time in France, Holland, and Germany, and in various sections of the United States. The disease was first recorded in 1869 in the Zoological Garden in Hamburg, Germany, and in France in 1876, where careful observations were made and the name *Ichthyophthirius multifiliis* proposed by Fouquet. In America the parasite is prevalent in small ponds, reservoirs, and aquaria, where it spreads rapidly, causing a heavy mortality of most of our common fresh-water fishes.

[1] Appendix IX to the Report of the U. S. Commissioner of Fisheries for 1923. B. F. Doc. No. 959.

[2] The author is particularly indebted to Dr. H. S. Davis, fish pathologist of the Bureau of Fisheries, for criticism in reviewing the manuscript and for suggestions during the course of the work.

SYMPTOMS OF THE DISEASE.

The first symptoms of the presence of Ichthyophthirius are the queer actions of the fish and the appearance of small, whitish-gray, sharply defined pimples sticking out over the surface of the body. When the fish are first infected they rub themselves continually against the bottom and sides of the tank in an attempt to brush off the young parasite. In a short time they will be seen to hang listlessly in the water with drooping fins, or gasping at the surface due to the impaired condition of the gills. All parts of the body, head, sides, fins, and especially the mouth and gills, may be heavily infected by these organisms.

As the parasite grows it becomes visible as a raised light-colored spot on the fish, and if these are numerous the adjacent ones may touch each other and unite to form a large spot, giving the skin a mottled appearance. As the disease spreads the raised spots often occur by the hundreds and thousands, covering the entire external surface of the fish. Fish that become heavily infected soon stop eating, and in the last stages of the disease they are covered with a heavy slime and red blotches or "scalded" areas. Fungus soon develops on the raw parts of the fins and body, and the fish live but a short time.

DESCRIPTION OF THE PARASITE.

The adult parasite may be identified by gently scraping off one of the "spots" from the fish and carefully examining it under the microscope. It may be necessary to separate the animal from the tissue surrounding, in which it is generally found in active rotating movement. The adult parasites range in size from one-half to slightly less than 1 millimeter in diameter. The body is round or elongate oval in shape when it is inactive, but will assume almost any form when in motion. Covering the outer surfaces are numerous short threadlike cilia arranged regularly in rows, which serve to propel the animal through the water. The protoplasm of the body contains numerous opaque granules, a large crescent-shaped nucleus, a small oval opening or mouth, and many fine contractile vacuoles. (See fig. 7.) In warm water the animal soon surrounds itself with a semitransparent membrane or cyst and there undergoes many successive divisions, forming thousands of young parasites.

LIFE HISTORY OF THE PARASITE.

In order intelligently to combat the disease, a thorough knowledge of the life history is necessary. The young parasite is a microscopic, free-swimming form, which revolves rapidly through the water in search of a host. Upon coming in contact with a fish it endeavors to burrow into the epidermis, especially in the gills, fins, and unscaled regions. At this time the fish is irritated the most and tries hardest to brush it off. If the young parasite is unable to find a host, it will die within a few days, as it seems incapable of taking food from the water. Fish that have been previously infected are covered with a layer of slime, which offers an unusually favorable medium for attachment for the young parasites. When once embedded in the skin of the fish, the parasite begins to grow rapidly with the nourishment

it absorbs from the tissues and is soon a visible white spot on the outside of the fish. The small white body increases in size and in warm water (65 to 75° F.) will leave the fish in two to five days as an adult free-swimming form.

Upon leaving the fish it drops to the bottom, and after swimming around for a short time forms a cyst. Generally the cyst remains on the bottom, though in some cases it may be brought to the surface by suspended matter and air bubbles that collect around it. Within the wall of the cyst multiplication takes place, resulting in the for-

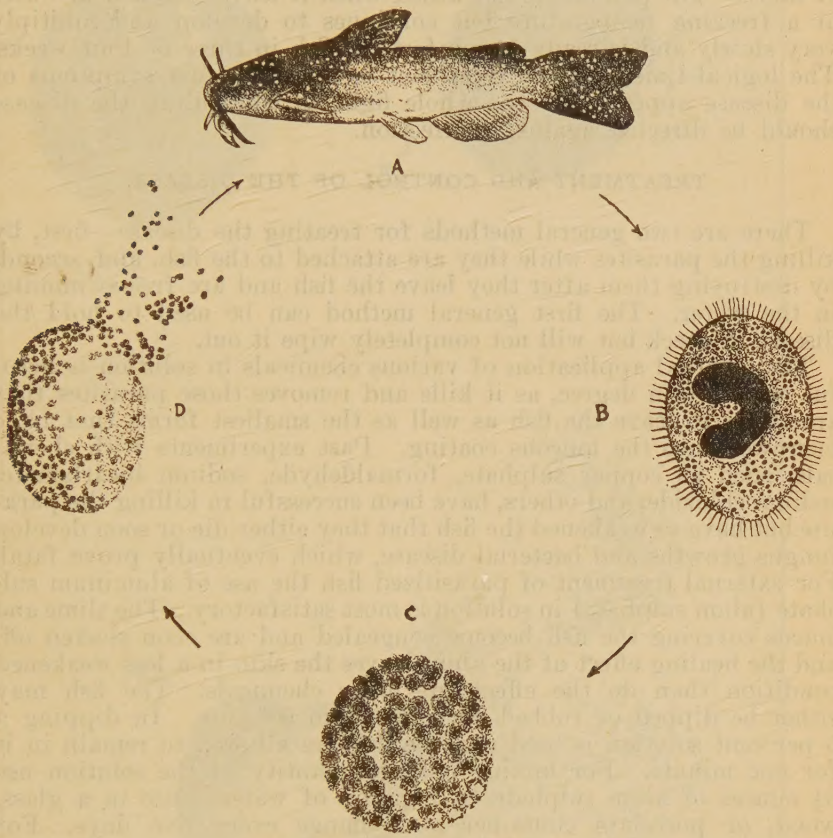

FIG. 2.—Life cycle of the parasite. A, adult parasites on catfish; B, parasite after leaving fish as a free-swimming form and settling to the bottom; C, division of adult into many smaller individuals after formation of a cyst; D, bursting of cyst, releasing hundreds of minute parasites, which in turn reinfect the fish.

mation of large numbers of minute individuals that are invisible to the naked eye and about 30 μ (.03 millimeter) long. When reproduction is completed, the wall of the cyst bursts open (see fig. 5), releasing thousands of young parasites, which immediately go in search of a host.

The parasites that drop from the fish are of various sizes, some being much larger than others. A corresponding variation is noticed in the numbers of young formed within a cyst, which range from approximately 500 to 2,200 minute individuals. This is the

usual method of reproduction, though the parasite may undergo one or two stages of division while embedded on the host or as a free-swimming form after leaving the fish. The rapidity with which the parasite goes through its life cycle depends on the temperature of the water, the kind of fish infected, the region in which it becomes embedded, and the metabolic activity of its host.

Under general conditions the parasite will remain on the fish for five or six days in warm water of 65° F. or higher, and, on the other hand, in water of 35 to 40° F. it may not leave the fish for a month or more. The parasite is not killed when it leaves the fish in water at a freezing temperature but continues to develop and multiply very slowly and is ready to reinfect the fish in three or four weeks. The logical time to begin treatment is when the first symptoms of the disease appear, and the whole fight in controlling the disease should be directed against reinfection.

TREATMENT AND CONTROL OF THE DISEASE.

There are two general methods for treating the disease—first, by killing the parasites while they are attached to the fish, and, second, by destroying them after they leave the fish and are free-swimming in the water. The first general method can be used to hold the disease in check but will not completely wipe it out.

The external application of various chemicals in solution is helpful to a certain degree, as it kills and removes those parasites that are about to leave the fish as well as the smallest forms that have burrowed into the mucous coating. Past experiments with chemicals, such as copper sulphate, formaldehyde, sodium bicarbonate, sodium chloride, and others, have been successful in killing the parasite but have so weakened the fish that they either die or soon develop fungus growths and bacterial disease, which eventually prove fatal. For external treatment of parasitized fish the use of aluminum sulphate (alum sulphate) in solution is most satisfactory. The slime and mucus covering the fish become congealed and are soon shaken off, and the healing effect of the alum leaves the skin in a less weakened condition than do the effects of other chemicals. The fish may either be dipped or rubbed with the alum solution. In dipping a 5 per cent solution is used and the fish are allowed to remain in it for one minute. For mixing a large quantity of the solution use 6½ ounces of alum sulphate to 1 gallon of water, store in a glass, wood, or porcelain container and change every five days. For rubbing or brushing the fish a 3 per cent solution is used, or 4 ounces of alum sulphate to 1 gallon of water. The fish are laid in a shallow pan with about half an inch of the solution in the bottom of it, and the affected parts are gently rubbed with saturated cheesecloth or a brush. These chemical applications have been used successfully on carp, catfish, bass, sunfish, goldfish, Fundulus, bream, and trout, but were only helpful as a means of holding the disease in check by killing those parasites that were about to leave the fish. Alum sulphate has also given excellent results in the treatment of Saprolegnia when applied in a 3 per cent solution to the diseased parts of the fish.

The second general method for combating the parasite is the most practical and should be put into effect in every possible case. It

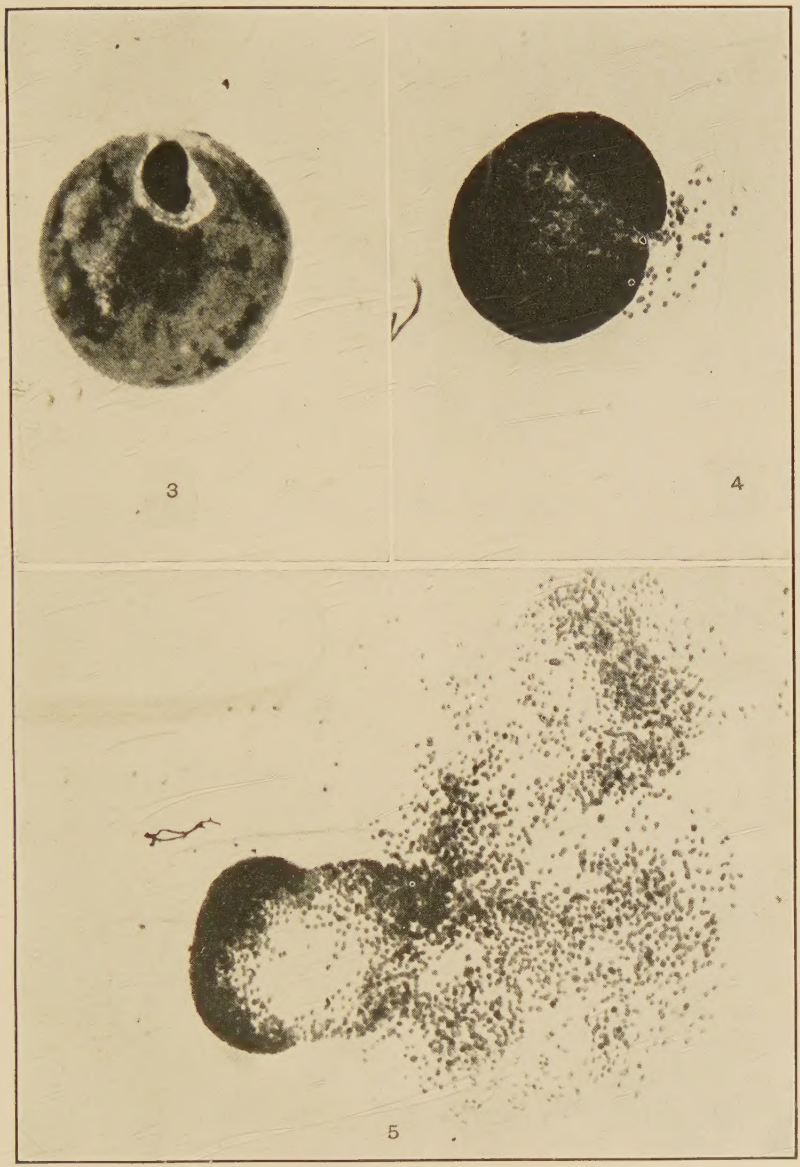

FIG. 3.—Adult parasite as it appears by transmitted light. Highly magnified.
FIG. 4.—Cyst filled with minute young parasites about to burst open. Highly magnified.
FIG. 5.—Bursting of cyst and escape of large numbers of young parasites. Highly magnified.

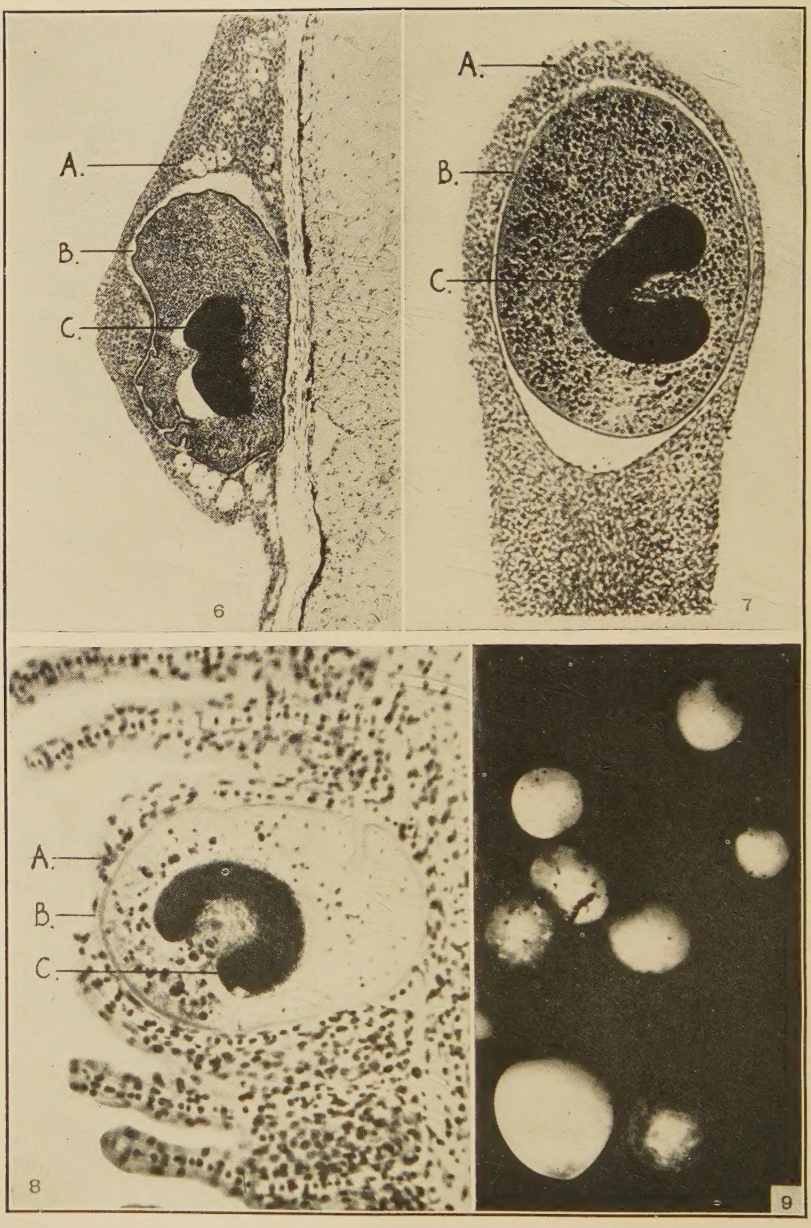

FIG. 6.—Cross section of skin and external muscles of small catfish, showing the parasite lying beneath the epithelium. A, epithelial layer; B, outer cell wall of parasite; C, nucleus of parasite. Highly magnified.

FIG. 7.—Portion of the gill of a buffalofish, showing large parasite within the epithelium. Symbols the same as in fig. 6. Highly magnified.

FIG. 8.—Section through a portion of the gill filament, showing embedded parasite. Symbols same as in fig. 6. Highly magnified.

FIG. 9.—Several parasites after removal from a fish, viewed by reflected light. Magnified 30 diameters.

(Material for photographs in figs. 6, 7, and 8 was furnished by Dr. H. S. Davis.)

consists in removing or destroying the large adult parasites after they have dropped off the fish. This may be accomplished by placing the fish in swiftly running water, which carries away the parasites before they have time to multiply and reinfect the fish. Long troughs or cylindrical tanks can be easily equipped for this purpose. The inside of the receptacle used should be coated with asphalt paint, so that the surface will be smooth and not likely to prevent the parasites from being washed away. The intake must be constructed in such a way as to maintain a steady flow of water throughout the length of the trough. At the overflow the water must be drained off from the bottom as well as the top in order to insure removal of the parasites whether they sink or are carried to the surface of the water. In the case of cylindrical tanks (see fig. 10) the rotation of the water causes the parasites to settle at the center of the tank, where they are immediately carried away. The treat-

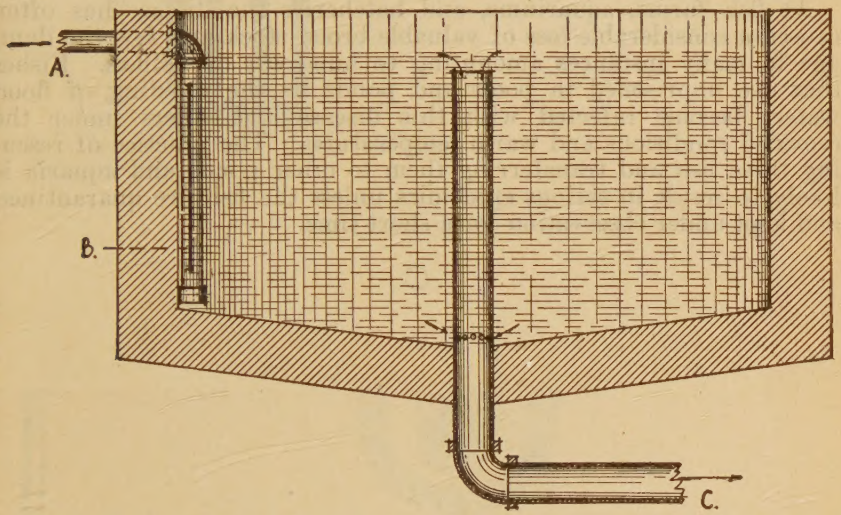

FIG. 10.—Apparatus for the removal of parasites by a continuous flow of water. A, intake; B, water-spreader for inducing rotary circulation; C, drain from surface and bottom outlets.

ment may be made even more positive by scrubbing the trough or tank every day with a strong salt solution after removing the fish. In warm weather infected fish may be cured by this method in 7 to 10 days, and further epidemics can be prevented by quarantining newly brought in stock in this way. Successful treatment in any case depends upon combating the disease when the first symptoms are noticed and continuing it until all the parasites have had a chance to drop from the fish.

In some instances swiftly flowing brooks or small streams might be utilized by fencing off a suitable section and placing the fish in it until cured. Fish in aquaria can be cured of the parasite, first, by removing all sand and dirt so as to have the bottom of the tank clean; second, by using about five large tadpoles to each square foot of bottom surface; third, by siphoning off each day all waste material that settles at the bottom; and, fourth, by adding a level

tablespoon of salt to each gallon of water about every other day. Goldfish and tadpoles will eat the parasites and by so doing prevent a rapid spread of the disease.

Nets and siphons used around infected fish should be sterilized each time they are used in a strong brine solution lest the parasites be transferred to other tanks.

ECONOMIC IMPORTANCE.

The parasite Ichthyophthirius has proven fatal to catfish, sunfish, smallmouth black bass, goldfish, buffalofish, trout, bowfin, carp, tench, bream, crappie, white bass, pike perch, pickerel, pike, and whitefish, as well as to many tropical aquarium fishes. Other freshwater species, such as perch, largemouth black bass, roach, sturgeon, gar pike, and eels seldom are killed by the disease or affected to any noticeable degree.

At fish farms, aquariums, and hatcheries the disease has often caused a considerable loss of valuable brood stock and fry, the damage in many instances amounting to hundreds of dollars. Fishes that are imprisoned in pools and ponds by the receding of flood waters become infected with this disease and others under the crowded conditions and warm temperatures. The practice of rescuing these fish and transferring them to other ponds and aquaria is likely to result in serious epidemics unless the fish are quarantined and kept under observation for a short time.

○